Flagstaff Interface Treatment Prescription

Results in the Wildland/Urban Interface

by

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Abstract

Over the past five years, fire managers in the Flagstaff Wildland/Urban Interface have developed a system of socially welcomed fuel reduction treatments that have proven effective in reducing wildfire hazard, improving probability for successful initial attack, maintaining and enhancing vegetative diversity, and initiating improvement of overall forest health. The long term objective of the program is to facilitate stewardship of forested properties within the interface, regardless of ownership or jurisdiction.

The Flagstaff Interface Treatment Prescription incorporates not only forestry and fire science but also community and neighborhood input as vital components in successfully developing, implementing, and maintaining the treatments. With several thousand acres now treated, other benefits and lessons have been noted as well.

Introduction

Flagstaff, Arizona, located in north-central Arizona, is a high elevation (7,000 feet) metropolitan area surrounded by a dense ponderosa pine forest (Figure 1 and 2). The annual number of wildland fire starts in and immediately adjacent to the interface area averages over 200 per year, with some years recording over 300 fires. Based upon existing hazard and values-at-risk, wildfire is the #1 fire threat to the community.

In the early 1990's, the U.S. Forest Service (USFS) began treating high-risk areas adjacent to and within the Flagstaff corporate boundary with the goal of reducing the fire threat to the southwest side of Flagstaff, including historic landmarks such as Lowell Observatory. The City of Flagstaff Fire Department (FFD) began a fuel management program after the severe 1996-wildfire season. The Ponderosa Fire Advisory Council, a consortium of fire departments and land-management agencies from the greater Flagstaff area, has also supported and recently initiated fuel reduction projects. Since the program was started, several thousand acres have been successfully treated with overwhelming public support (Figure 3).

Completed fuel treatments complement the area's suppression system. With six staffed fire lookout towers that oversee the north end of the Coconino National Forest (including Flagstaff), early wildfire detection is usually possible. Once a report is received, the Coconino National Forest, which provides wildfire dispatch service to all fire agencies, can rapidly send initial attack units. An extensive road system usually enables initial attack forces to arrive on the fire scene within fifteen to thirty minutes from the time of the initial report.

Figure 1 Flagstaff circa 1900 - Photo courtesy of Lowell Observatory

Figure 2 Flagstaff 2000- Photo by Allen Farnsworth USFS

Photos taken from Mars Hill looking east. Sheep Hill is seen at the far left of each photo. In the 100 years between the photos, Flagstaff grew from a rural settlement to the major metropolitan center of northern Arizona.

Historical Trends

Prior to European settlement in the 1860's, the forest was comprised of relatively open stands of large-diameter ponderosa pine. Tree numbers averaged 30-50 per acre, with these trees arranged in small groups. While some young thickets were undoubtedly present, a savanna grass-land dominated the landscape. Fires were frequent, returning every 2-7 years, and were relatively low-intensity in nature.

By the 1880's, the forests were subjected to intense livestock grazing and timber harvesting. The removal of most of the grass, coupled with a period of relatively wet weather and the exceptional 1919 cone crop, saw many new seedlings established. For most of the 20th century, a policy of active fire suppression – almost to the point of fire exclusion – was embraced and practiced.

As a result, many of the pine stands are presently overstocked with small and mid-sized second-growth trees. Basal areas commonly range from 150 to well over 200 and tree density from several hundred to a few thousand per acre. Canopy closure typically varies from 50 to 70% but often approaches 100%. An occasional juniper, pinyon pine, Douglas fir, white fir, Gambel oak, limber pine or aspen occurs among the pine stands. Insect and disease problems in these stands include dwarf mistletoe and periodic episodes of various bark beetles.

Sites are best represented by Fire Behavior Prediction System (FBPS) Fuel Model #9 - closed-canopy pine stand with needle understory. In the few open areas, the ground cover is a mix of grasses and forbs. Heavy logging slash from the early 1900's such as pitchy high stumps and cull trees contribute to the fire hazard and laddering potential.

Goals

Generally, the goals are four-fold:

1. Reduce the wildfire hazard through a combination of thinning, brush disposal and prescribed fire.

2. Maintain and enhance vegetative species and structural diversity of the site.

3. Improve overall forest ecosystem health.

4. Engage individual property owners and the community in the effort.

The objective is to facilitate treatment of forested properties, regardless of boundary lines or jurisdictions within the area. All stands or parcels are considered valuable components of the overall ecosystem. Acres-treated is the benchmark by which we measure success.

Silvicultural Prescription

The area is a true wildland/urban interface forest, and the silvicultural prescription is fairly basic.

Selective thinning, focusing on over-topped pines, is preferred. Target basal area for mistletoe-free stands is 60 to 100. If possible, "leave" trees are left in a clumped pattern rather than evenly spaced. This benefits certain wildlife species, as well as avoids a plantation appearance. Trees designated for removal are those which:

1. Create a ladder fuel effect into the overstory canopy.
2. Are suppressed or are suppressing otherwise healthy trees.
3. Exhibit reduced vigor.
4. Are damaged or deformed and contribute to fire potential.

Stands with high infestation levels of dwarf mistletoe, are thinned to reduce crowning potential during the inevitable wildfire. Small isolated pockets of mistletoe -- less than ¼ acre -- are either:

- Isolated from non-infected trees by a barrier of fifty feet to reduce further spread of the parasite, or
- Removed.

Old growth and large diameter "blackjack" pines are showcased by removing thickets of younger trees from around their base (generally within thirty feet). Oaks or other preferred species can also be highlighted by removing some or all of the encroaching pines. Other unique features, such as geologic protrusions, scenic vistas or uncommon ground vegetation, can be enhanced as well by selective removal of young pines.

Figure 3. This parcel between Sinaqua High School and FFD Station 4, was broadcast burned following selective thinning. Photo by Allen Farnsworth USFS

Under this prescription the cutting of old growth, large diameter "blackjack" pines, or standing snags is avoided unless these trees pose a threat to public safety or improvements, such as a tree leaning over a home, play area, powerline, road or hiking trail.

This prescription is considered a moderate-to-heavy modification of the existing stand, involving removal of 50-75% of the existing trees, mostly of small diameter.

Designating Trees for Removal

Simple guidelines, issued by the project manager either verbally or in writing to the crew, have worked well. Where possible, a cutter selection method is preferred. If necessary, a sample cut can be designated and reviewed by the thinning crew.

Where designating trees with paint is necessary, a cut-tree mark, as opposed to a leave-tree mark is preferred. Marking cut-trees eliminates the long term appearance of a leave-tree mark. However, one method being considered in areas scheduled for follow-up underburning involves placing only one paint mark on the leave tree as close to the ground as possible so that the scorch from the underburn will hide or eliminate the paint.

When designating trees for removal, personnel must be aware of fire behavior alignments such as prevailing wind direction, shading, slope, fuel arrangement and continuity, and potential fireline locations. Careful consideration also needs to be given to the type of fuel model conversion that may result from treatment. Converting a stand from a FBPS Fuel Model 9 to a FBPS Fuel Model 2 (open pine stand with grass understory) may be more appropriate directly adjacent to a control feature such as a road, trail or natural barrier.

Cutting Techniques

The type of mechanized operation should be given serious consideration when cutting in the interface. A traditional harvesting operation may not be suitable in some areas, while in others it may be the preferred method. Although we use traditional timber-harvesting equipment under certain conditions, we typically utilize a "micro" harvesting approach. Trees are cut either using hand-crews with power saws or by a Bobcat shear. Wood is moved by an All-Terrain-Vehicle (ATV) with a trailer. This is not as disturbing to area residents as would be the case with larger equipment, and it allows curious people to readily approach our crews to learn about the operation, something we encourage. In addition, smaller equipment reduces soil compaction and disturbance, minimizing the amount of soil exposed for noxious weed and other exotic plant establishment, as well as soil erosion.

Restricting hours of operation in response to local conditions is another consideration. For example, if an operation is immediately adjacent to homes or a neighborhood, we typically restrict activity to those hours when most people are not home.

Stumps should be cut as low to the ground and as level as possible. This not only improves post-treatment visual quality, but facilitates wood removal and subsequent fire management needs by allowing easier access.

As much as possible of the required slash treatment should be completed daily. Leaving untreated slash – even for a few days – invites criticism from concerned residents in the area.

Utilization

To the maximum extent possible, wood produced from thinning operations should be removed and utilized. Occassionally, some material may be left on-site as wildlife cover. Although current commercial markets are slim for many of the products we produce, we have had a great deal of success by designating accessible areas as free-use wood areas. Each fall, the Flagstaff Fire Department's free wood Saturdays typically draw 200+ people who will remove 100 cords of firewood in half a day. To facilitate removal, firewood must be cut into 2 to 3 foot lengths, and poles into 10 foot lengths (Figure 4).

Figure 4. Firewood on Mars Hill was removed by the public on a designated free wood collection day. Photo by Paul Summerfelt FFD

Access through neighborhoods for wood removal needs to be discussed with adjacent homeowners during the initial planning stages, not after cutting is underway.

Without a market for these products, or in areas where removal is not practical, the project manager must carefully consider the size and number of the trees designated for cutting on any one site. More than one cutting cycle may be required so as to not overload the ability to treat the resulting slash in a timely manner.

Slash Treatment

Hand Piles: This is the typical method of handling slash. Hand piles should be teepee-shaped and a minimum of six feet tall and six feet wide. Pile placement needs to be carefully considered. Piles should be located in openings to avoid scorching leave trees when the piles are later burned. Likewise, placing piles on top of old stumps or logs should be avoided to reduce both the amount of smoke and the chance for "creep" when the piles are later burned. We have found that to the public, a scorched tree is worse than a cut tree and "creep" is an "escaped controlled burn."

Machine Piles: This method is sometimes feasible in more open areas. We have had the most success with the windrow piling method perfected on the Mormon Lake Ranger District. This requires directional falling into a windrow that can then be pushed into large piles by a dozer during a single pass. Because the dozer is not constantly spinning and turning, few ruts are made. The larger piles result in fewer piles per acre, speed production by an estimated 30%, and can be ignited under snowier or wetter conditions than traditional hand piles. At first, some were

skeptical of this method, but once the process and results have been observed, comments have been favorable. We have also employed whole tree skidding.

Chip or Grind: Although, occasionally used this technique is comparatively expensive and chips decompose slowly in our area. If future underburning is anticipated for the site, chips may add to smoke management problems. The material can, however, be used for mulch or decorative landscaping. Hauling chips to a disposal site is expensive.

Lop-and-Scatter: The decision to utilize this method should receive careful consideration. If the amount of slash is light and the manager can complete a broadcast burn soon after cutting, it may be effective. However, we seldom use this method. Due to the increased fire hazard, dried lopped-and-scattered slash should never be left in-place adjacent to homes.

Pile Burning

Piles should be burned only when consumption will be greater than 90%. A test pile may need to be burned to ensure this is achievable. All pile burns should be conducted under conditions intended to reduce scorch, minimize smoke issues, and lessen potential control problems. Quality is the number one concern, not acres treated per day. This is the case regardless if the material is hand or machine piled.

Because we intend to broadcast burn most, if not all, sites we work on, we often pile some of the existing dead-and-downed material. These piles are then burned when the slash piles resulting from thinning are burned, which aids in smoke reduction during the following broadcast burn. Some material is left onsite for wildlife cover.

Hand Piles: As a standard practice, we wait for either snow cover or an extended wet weather episode. On burn day, the crew will ignite a reasonable number of piles. As they burn-down, the crew goes back through the area and consolidates each pile 2-3 times to ensure complete, and timely consumption. The work pace is governed by the intent to have all piles burned-down by nightfall.

Machine Piles: When burning this type of pile, we wait for snow. As the piles are burned, a small dozer is ideally on-hand to shape up the piles and landings. While the dozer is working, seed can be spread and worked into the ground. This results in faster site recovery, less likelihood of noxious weeds becoming established, and reduced visual impact.

Broadcast Burning

Treating ground fuels is a critical component of our stand enhancement and fuel reduction effort. Once an area has been thinned and the slash has been treated, the site should be broadcast burned (Figure 5). As our prevailing wind is from the southwest, burn blocks, where possible, are burned starting in the northeast and working toward the southwest. Fireline is usually constructed by hand or with a drag pulled by an ATV.

As a standard practice, standing dead trees are either hand lined or otherwise excluded from the burn block. The same is true for cultural or archaeological sites or other features important to the manager that might be degraded by fire.

Figure 5. This parcel at the Brannen Homes development was broadcast burned following selective thinning, pruning, and slash disposal. .
Photo by Larry McCoy USFS

Once ignited, deep duff and needle accumulation at the base of the larger older trees will often smolder for days. This essentially bakes the cambium layer and death can occur 1-2 years or more after the burn. To avoid such damage, the duff and needle material is routinely raked away from high-risk trees. Usually raking to a distance of one foot from the bole is sufficient. We do the same for downed logs we wish to preserve for wildlife cover.

The preferred season for broadcast burning is normally during breaks in the summer monsoon season, during the transition from the monsoon season to drier fall weather or during the fall and early winter. While spring burning is sometimes used, it must be balanced against resource availability, training commitments, and the normally escalating fire danger indices prevailing at this time of year. However, if the planned burn is small, of short duration, and anchored to a recent burn or fuel break, spring burning can be done with reasonable safety.

Our ultimate goal is to shift more burns into the summer months to recreate the historical fire regime. This will become easier once a site has been previously burned to remove excessive accumulations of fuel.

The underburning prescription generally calls for strip-head fires along with a combination of backing fires (used at starting points and on steep slopes) with target flame lengths of 1 to 3 ft. Ignition by hand with drip torches or with ATV-mounted torches is preferred. Ignition is usually begun at mid-morning following the break-up of the night time temperature inversion and the establishment of the day time wind pattern. Every effort is made to complete ignition by early afternoon, with burn blocks generally kept small to achieve this objective.

Although each burn block may have specific objectives, we generally have two overall objectives for the operation:

1. Reduce 1 and 10 hour fuels by a minimum of 60%, and

2. Keep tree mortality to less than 5% of the existing stand.

Intense public notification is an essential element of the program. This is achieved by posting signs in the area announcing the proposed burn, news releases, and in many cases, door to door contact throughout the nearby neighborhood(s). Any concerns receive immediate attention, either by a phone call or personal visit. If these concerns surface on the day the site is being burned, we often detail the project manager or a crewmember to visit the person while the fire is still underway. We also conduct a continuing education program through talks to civic groups, environmental organizations, and others to inform the community of the importance and benefits of the program.

Our experience has shown that a previously notified neighborhood is willing to tolerate smoke for a day, but after 2-3 days, patience wears thin. A particular log, stump, or site within a burn unit may be extinguished the first night if it becomes a major concern to a nearby resident.

We attempt to design our burns so they can be dispersed throughout the community so as to not constantly impact the same neighborhood(s). The Flagstaff Fire Department has offered to relocate smoke sensitive people: to-date, however, no one has taken advantage of the offer. Neighborhood air sheds, indicated by diurnal smoke flows, are routinely mapped so we can plan future smoke management efforts.

Maintenance

Once the thinning, slash treatment, and first underburning have been completed, the treated area constitutes an effective fuelbreak for at least the next three to four years. Follow-up thinning and maintenance burns are scheduled as necessary to ensure long-term reduction of the risk of destructive fire.

Typically, thinning is rescheduled every 10-15 years, while broadcast burns are on a 3-7 year cycle. Smoke management concerns are much less during such maintenance burns.

Community Involvement

Throughout the entire operation, the project manager must maintain contact with potentially affected residents. We routinely gather input from such persons, consider their concerns and beliefs, and where possible, incorporate their desires into the overall effort (Figure 6). We commonly go door to door to each residence that borders the proposed project to explain the project and gather first-hand comments. Follow-up visits are paid to those people who have questions or concerns. If necessary, a "case-officer" is assigned so the resident deals with the same person from the start of a project to the end.

Some might believe that people would prefer their privacy and ask for no or limited treatments next to their property line. However, we have rarely found this to be the case. In fact, most often the opposite is true: property owners want the work carried onto their land, or onto other adjacent or nearby property.

Figure 6. Project managers routinely meet with nearby residents prior to initiating treatments. Photo by Allen Farnsworth USFS

We have made a concerted effort to involve local businesses in our thinning efforts. Prior to 1998, no more than 10 contracts per year were issued. Since 1998, approximately 60 have been issued each year.

Although it takes considerable time and commitment, we believe this one-on-one community involvement is essential for the success of our program.

Costs

Individual project expenses vary tremendously from site-to-site based on ownership, size, complexity, and need. It is difficult to compare one site to another, especially initial treatment vs. maintenance requirements.

What should be considered is the cost of doing nothing. For our area, it is no longer a question of "if" a wildfire will occur, but "when", "where", and "how much damage" will result. We want to work with the residents before the wildfire, not during or after it.

Benefits

We have experienced wildfires in several of our treated areas and have noticed the following:

- Improved access for fire fighters and apparatus.
- Increased ability to utilize barriers when locating and constructing line.
- Easier detection and suppression of spot fires.
- Decreased mop up time and effort.
- Reduced torching and mortality.
- Expanded options for a modified suppression response.
- Improved public safety

In addition, we have realized reduced trash accumulation through elimination of hiding cover necessary for transient camps and party spots. We also clean-up existing trash during operations.

Recommendations

Our level of expertise with the program has led to the development of the following guidelines:

1. Involve those potentially impacted or affected from the very beginning.
2. Once the project is started, commit to complete it in a timely manner.
3. Use signs, news releases, and other appropriate methods to update people on the status of the project.
4. Avoid stone-walling. When mistakes happen, immediately notify each adjacent resident, explain what happened and why, and advise them of what is being done to correct the situation. Assume full-responsibility: allow on-site personnel to make commitments to address a problem.
5. Document and follow-up special concerns or small details that may be important to a concerned individual. Personal "client" service is an absolute necessity. We must always strive to maintain the professionalism, integrity and credibility that have been established.
6. Stay focused on the ultimate objective. Reduction of fire risk requires us to produce stumps and smoke. If we are not doing that, we are not successful.

7. Success leads to success. Many landowners throughout the community have seen the ongoing and completed treatments and have implemented similar treatments on their own land.

[i] Prescribed Fire Specialist with the Coconino National Forest and Fuel Management Officer with the Flagstaff Fire Department, respectively.